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09/705,668	11/02/2000	Darrell D. Boggs	042390.P9576	6260

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EXAMINER	
LI, AIMEE J	

ART UNIT	PAPER NUMBER
2183	

DATE MAILED: 09/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/705,668	BOGGS ET AL.
	Examiner	Art Unit
	Aimee J Li	2183

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 02 November 2000 and 07 October 2002 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-24 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-24 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 02 November 2000 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 and 4 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1-24 have been considered.

Papers Submitted

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: CFR as received on 13 June 2003; IDS as received on 22 July 2002; and IDS as received on 07 October 2002.

Information Disclosure Statement

3. In regards to the PCT search reports cited in the IDS packets received on 22 July 2002 and 07 October 2002, the PCT search reports have been considered. However, the references listed in the reports have not been considered. The references listed on the reports would not be shown on the patent publication should the application be allowed.

Drawings

4. This application, filed under former 37 CFR 1.60, lacks formal drawings. The informal drawings filed in this application are acceptable for examination purposes. When the application is allowed, applicant will be required to submit new formal drawings. In unusual circumstances, the formal drawings from the abandoned parent application may be transferred by the grant of a petition under 37 CFR 1.182.

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: page 7, line 25 elements 1011 and 1001; page 14, line 26 element 128; and page 14, line 32 e7lement 130. A proposed drawing correction or corrected drawings are required in reply to the Office action to

avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sager, U.S. Patent Number 5,966,544 (herein referred to as Sager) in view of Akkary, WO 99/31589 (herein referred to as Akkary).

8. Referring to claims 1, 10, 11, and 13 Sager has taught a processor comprising:

a. A replay queue to receive a plurality of instructions (Applicant's claims 1 and 13) (Sager columns 9-10, lines 63-6 and Figure 7);

b. An execution unit to execute the plurality of instructions (Applicant's claim 1) (Sager column 8, lines 64-67 and Figure 7);

c. At least two execution Units to execute the plurality of instructions (Applicant's claim 13) (Sager column 5, lines 33-35; column 8, lines 64-67; and Figure 7);

d. A scheduler coupled between the replay queue and the execution unit to speculatively schedule instructions for execution (Applicant's claim 1) (Sager column 10, lines 27-33);

e. At least two schedulers coupled between the replay queue and the execution units to schedule instructions for execution (Applicant's claim 13) (Sager column8, lines 52-63; column 10, lines 27-33; and Figure 7); and

f. A checker coupled to the execution unit to determine whether each instruction has executed successfully, and couples to the replay queue to communicate to the replay queue each instruction that has not executed successfully (Applicant's claims and 13) (Sager column 9, lines 20-49 and Figure 7).

9. Sager has not explicitly taught:

a. To increment a counter for each of the plurality of instructions to reflect the number of times each of the plurality of instructions has been executed, and to dispatch each instruction of the plurality of instructions to the execution unit either when the counter does not exceed a maximum number of replays or, if the counter for the instruction exceeds the maximum number of replays, when the instruction is safe to execute (Applicant's claim 1);

b. Wherein the scheduler comprises a plurality of counters to maintain each of the plurality of counters for each of the plurality of instructions (Applicant's claim 10); and

c. Wherein the counter is one of a plurality of counters such that each counter of the plurality of counters is paired with one of the plurality of instructions (Applicant's claim 11).

10. However, Sager has taught that instructions that must repeat in the replay queue are older instructions and, usually, have higher priority (Sager column 10, lines 34-46). Akkary has taught:

a. To increment a counter for each of the plurality of instructions to reflect the number of times each of the plurality of instructions has been executed, and to dispatch each instruction of the plurality of instructions to the execution unit either when the counter does not exceed a maximum number of replays or, if the counter for the instruction exceeds the maximum number of replays, when the instruction is safe to execute (Applicant's claims 1 and 13) (Akkary page 17, lines 7-18 and Figure 13);

b. Wherein the scheduler comprises a plurality of counters to maintain each of the plurality of counters for each of the plurality of instructions (Applicant's claim 10) (Akkary page 17, lines 7-18 and Figure 13); and

c. Wherein the counter is one of a plurality of counters such that each counter of the plurality of counters is paired with one of the plurality of instructions (Applicant's claim 11) (Akkary page 17, lines 7-18 and Figure 13).

11. A person of ordinary skill in the art at the time the invention was made would have recognized that the counter is a method for tracking the age of the instructions in the replay queue and the scheduler is better able to schedule instructions without any dependency problems arising with this information. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the counter of Akkary in the device of Sager to avoid dependency problems.

12. Referring to claims 2 and 15, Sager has taught an allocator/renamer coupled to the replay queue to allocate and rename those of a plurality of resources needed by the instruction (Sager column 8, lines 34-51 and Figure 7).

13. Referring to claim 3 and 16, Sager has taught a front end coupled to the allocator/renamer to provide the plurality of instructions to the allocator/renamer (Sager column 8, lines 32-33 and Figure 7).

14. Referring to claims 4, 5, 17, and 18, Sager has not taught:

a. A retire unit to retire the plurality of instructions coupled to the checker to receive those of the plurality of instructions that have executed successfully, and coupled to the allocator/renamer to communicate a de-allocate signal to the allocator/renamer (Applicant's claims 4 and 17); and

b. The retire unit is further coupled to the replay queue to communicate a retire signal when one of the plurality of instructions is retired (Applicant's claims 5 and 18).

15. Akkary has taught:

a. A retire unit to retire the plurality of instructions coupled to the checker to receive those of the plurality of instructions that have executed successfully, and coupled to the allocator/renamer to communicate a de-allocate signal to the allocator/renamer (Applicant's claim 4) (Akkary page 11, lines 17-24); and

b. The retire unit is further coupled to the replay queue to communicate a retire signal when one of the plurality of instructions is retired (Applicant's claim 5) (Akkary page 11-17-24).

16. A person of ordinary skill in the art at the time the invention was made would have recognized that the retire unit de-allocates memory and support devices associated with an instruction, leaving those elements free to be used by other instructions, thereby causing the system to be smaller and cheaper to build since those elements are being reused. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the retire unit of Akkary in the device of Sager to minimize the number of elements needed in the device.

17. Referring to claim 6, Sager has taught:

a. At least one cache on a die of the processor (Sager columns 2-3, lines 66-7; Figure 2; and Figure 7);

b. A plurality of external memory devices (Sager columns 2-3, lines 66-7 and Figure 2); and

c. A memory request controller coupled to the execution unit to obtain data from the at least one cache system and the plurality of external memory devices (Sager columns 8-9, lines 64-19 and Figure 7).

18. Referring to claim 7, Sager has taught at least one cache system comprises a first level cache system and a second level cache system (Sager columns 2-3, lines 66-7 and Figure 2).

19. Referring to claim 8, Sager has taught wherein the external memory devices comprise at least one of a third level cache system, a main memory, and a disk memory (Sager columns 2-3, lines 66-7 and Figure 2).

20. Referring to claim 9, Sager has taught a staging queue coupled between the checker and the scheduler (Sager column 9, lines 31-49 and Figure 7).

21. Referring to claim 12, Sager has taught wherein the checker comprises a scoreboard to maintain a status of a plurality of resources (Sager column 9, lines 50-53 and Figure 7). In regards to Sager, the checker checks the dependencies associated with the instruction and scoreboarding is a common technique used to do this.

22. Referring to claim 14, Sager has taught a plurality of memory devices coupled to the execution units such that the checker determines whether the instruction has executed successfully based on a plurality of information provided by the memory devices (Sager columns 2-3, lines 66-7; columns 8-9, lines 64-19; Figure 2; and Figure 7).

23. Referring to claims 19, 21, 22, and 23, Sager has taught a method comprising:

a. Receiving an instruction of a plurality of instructions (Applicant's claim 19) (Sager column 8, lines 32-33; columns 9-10, lines 63-6; and Figure 7);

b. Placing the instruction in a queue with other instructions of the plurality of instructions (Applicant's claim 19) (Sager column 8, lines 32-33; columns 9-10, lines 63-6; and Figure 7);

c. Speculatively re-ordering those of the plurality of instructions in a scheduler based on data dependencies and instruction latencies (Applicant's claim 19) (Sager column 8, lines 52-63);

d. Executing the instruction (Applicant's claim 19) (Sager column 8, lines 64-67 and Figure 7);

e. Determining whether the instruction executed successfully (Applicant's claim 19) (Sager column 9, lines 20-49 and Figure 7); and

f. Routing the instruction back to the queue if the instruction did not execute successfully (Applicant's claim 19) (Sage column 9, lines 20-49 and Figure 7).

24. Sager has not explicitly taught:

a. Dispatching one of the plurality of instructions to an execution unit to be executed either when a counter for the instruction does not exceed a maximum number of replays or, if the counter for the instruction exceed the maximum number of replays, when a required data for the instruction is available (Applicant's claim 19);

b. Maintaining a plurality of counters, one each for each of the plurality of instructions in the scheduler such that the counters reflect the number of times the corresponding instruction has been executed (Applicant's claim 22); and

c. Wherein each of the plurality of counters for the instruction is paired with each of the plurality of the instructions (Applicant's claim 23).

25. However, Sager has taught that instructions that must repeat in the replay queue are older instructions and, usually, have higher priority (Sager column 10, lines 34-46). Akkary has taught:

a. Dispatching one of the plurality of instructions to an execution unit to be executed either when a counter for the instruction does not exceed a maximum number of replays or, if the counter for the instruction exceed the maximum number of replays, when a required data for the instruction is available (Applicant's claim 19) (Akkary page 17, lines 7-18 and Figure 13);

b. Maintaining a plurality of counters, one each for each of the plurality of instructions in the scheduler such that the counters reflect the number of times the corresponding instruction has been executed (Applicant's claim 22) (Akkary page 17, lines 7-18 and Figure 13); and

c. Wherein each of the plurality of counters for the instruction is paired with each of the plurality of the instructions (Applicant's claim 23) (Akkary page 17, lines 7-18 and Figure 13).

26. A person of ordinary skill in the art at the time the invention was made would have recognized that the counter is a method for tracking the age of the instructions in the replay queue and the scheduler is better able to schedule instructions without any dependency problems arising with this information. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the counter of Akkary in the device of Sager to avoid dependency problems.

27. In addition, Sager has not taught:

a. Retiring the instruction if the instruction executed successfully (Applicant's claim 19);

b. De-allocating those of the plurality of system resources used by the instruction being retired (Applicant's claim 20); and

c. Removing the instruction and a plurality of related data from the queue (Applicant's claim 20).

28. Akkary has taught:

a. Retiring the instruction if the instruction executed successfully (Applicant's claim 19) (Akkary page 11, lines 17-24 and Figure 2);

b. De-allocating those of the plurality of system resources used by the instruction being retired (Akkary page 11, lines 17-24 and Figure 2) (Applicant's claim 20); and

c. Removing the instruction and a plurality of related data from the queue (Akkary page 11, lines 17-24 and Figure 2) (Applicant's claim 20).

29. A person of ordinary skill in the art at the time the invention was made would have recognized that the retire unit de-allocates memory and support devices associated with an instruction, leaving those elements free to be used by other instructions, thereby causing the system to be smaller and cheaper to build since those elements are being reused. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the retire unit of Akkary in the device of Sager to minimize the number of elements needed.

30. Referring to claim 20, Sager has taught allocating those of a plurality of system resources used by the instruction being retired (Sager columns 2-3, lines 66-7; columns 8-9, lines 64-19; Figure 2; and Figure 7).

31. Referring to claim 24, Sager has taught wherein the plurality of counters I stored in the scheduler (Sager column 10, lines 34-36).

Conclusion

32. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure as follows. Applicant is reminded that in amending in response to a rejection of

claims, the patentable novelty must be clearly shown in view of the state of the art disclosed by the references cited and the objections made. Applicant must also show how the amendments avoid such references and objections. See 37 CFR § 1.111(c).

a. Kalafatis et al., U.S. Patent Number 6,535,905, has taught a replay queue.

b. Sage, U.S. Patent Number 6,542,921, has taught a replay queue.

c. Rodgers et al., U.S. Patent Number 6,496,925, has taught a replay queue.

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J Li whose telephone number is (703) 305-7596. The examiner can normally be reached on M-T 7:30am-5:00pm.

34. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (703) 305-9712. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

35. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Aimee J. Li
Examiner
Art Unit 2183

September 17, 2003

EDDIE CHAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100